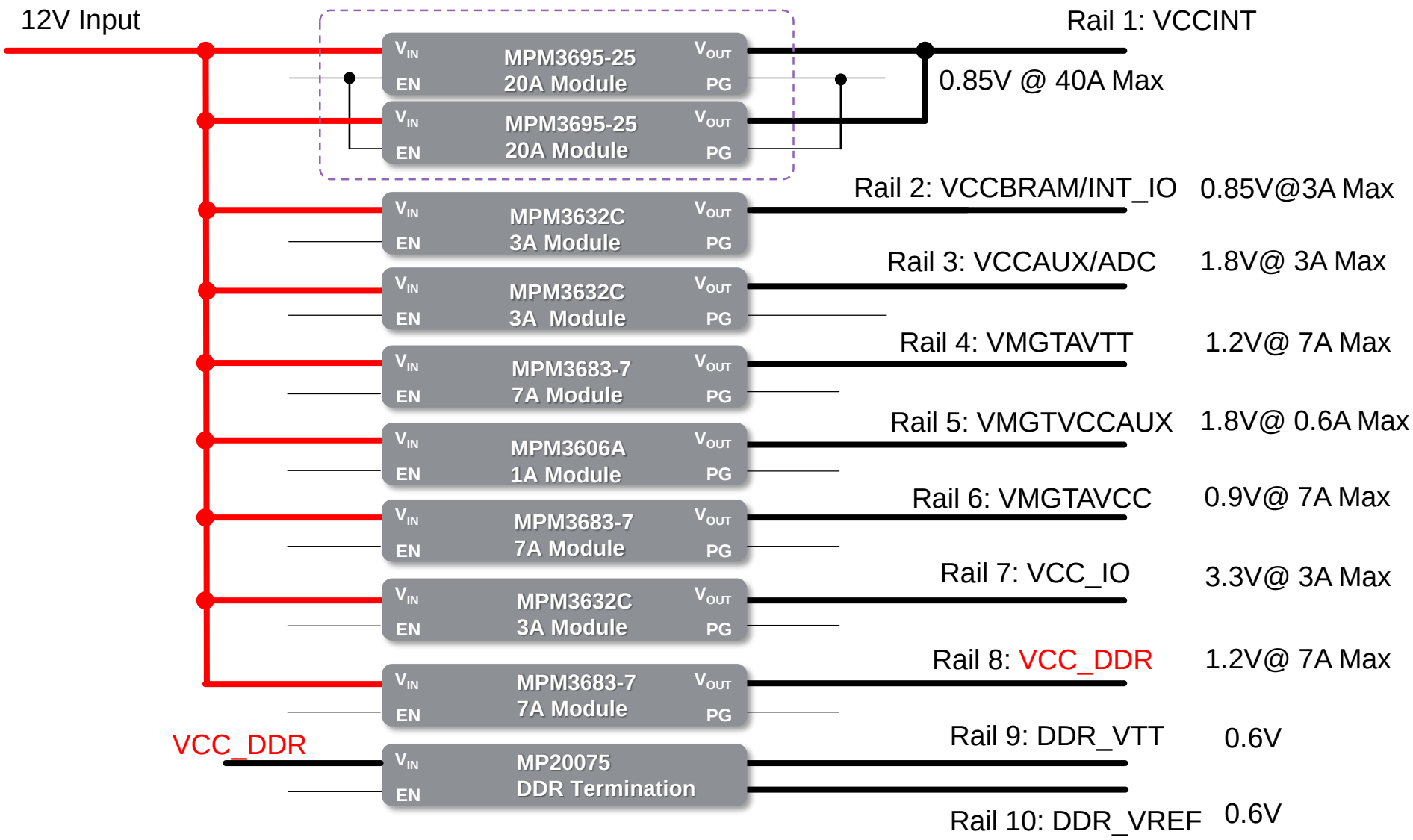
MPS Module Solution for Xilinx Kintex UltraScale+ FPGAs

Dec 2018

Solution Power Tree – High Power Version

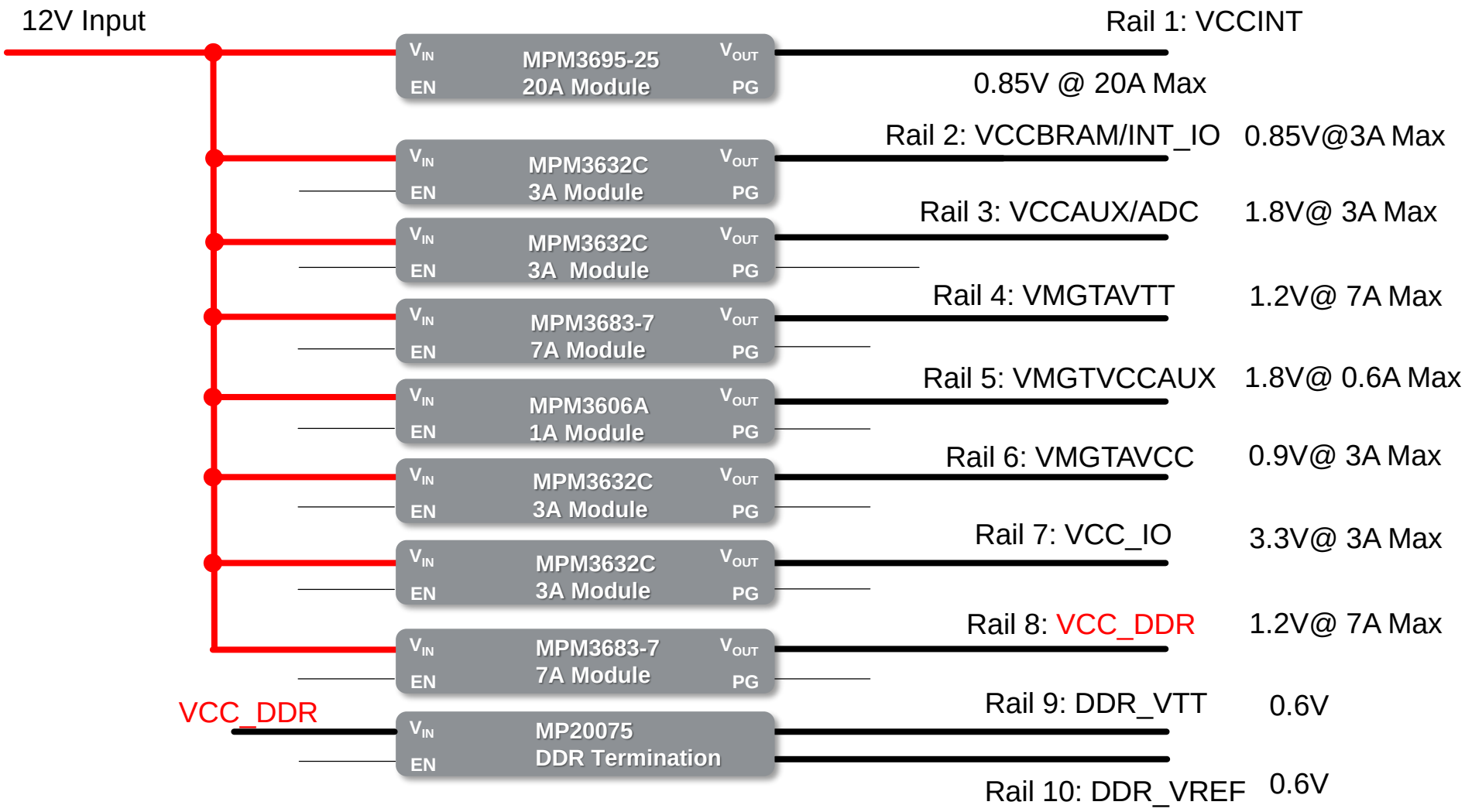


Summary of High Power Version

Rail Number	Rail Name	VOUT	Limit	Max DC Load	Seq Up	MPS Part#	PCB Area
1	VCCINT	0.85V	±3%	40A	1	MPM3695-25 x2	400 mm^2
2	VCCBRAM/ VCCINT_IO	0.9V	±3%	3A	2	MPM3632C	24 mm^2
3	VCCAUX/ADC	1.8V	±3%	3A	3	MPM3632C	24 mm^2
4	VMGTAVTT	1.2V	±3%	7A	2	MPM3683-7	75 mm^2
5	VMGTVCCAUX	1.8V	±3%	0.6A	3	MPM3606A	24 mm^2
6	VMGTAVCC	0.9V	±3%	7A	1	MPM3683-7	75 mm^2
7	VCC_IO	3.3V	±3%	3A	4	MPM3632C	24 mm^2
8	VCC_DDR	1.2V	±3%	7A	4	MPM3683-7	75 mm^2
9	DDR_VTT	VCC_DDR/2	±3%	N/A	4	MP20075	19 mm^2
10	DDR_VREF	VCC_DDR/2					

Total Solution Size: 689mm^2

Solution Power Tree – Low Power Version

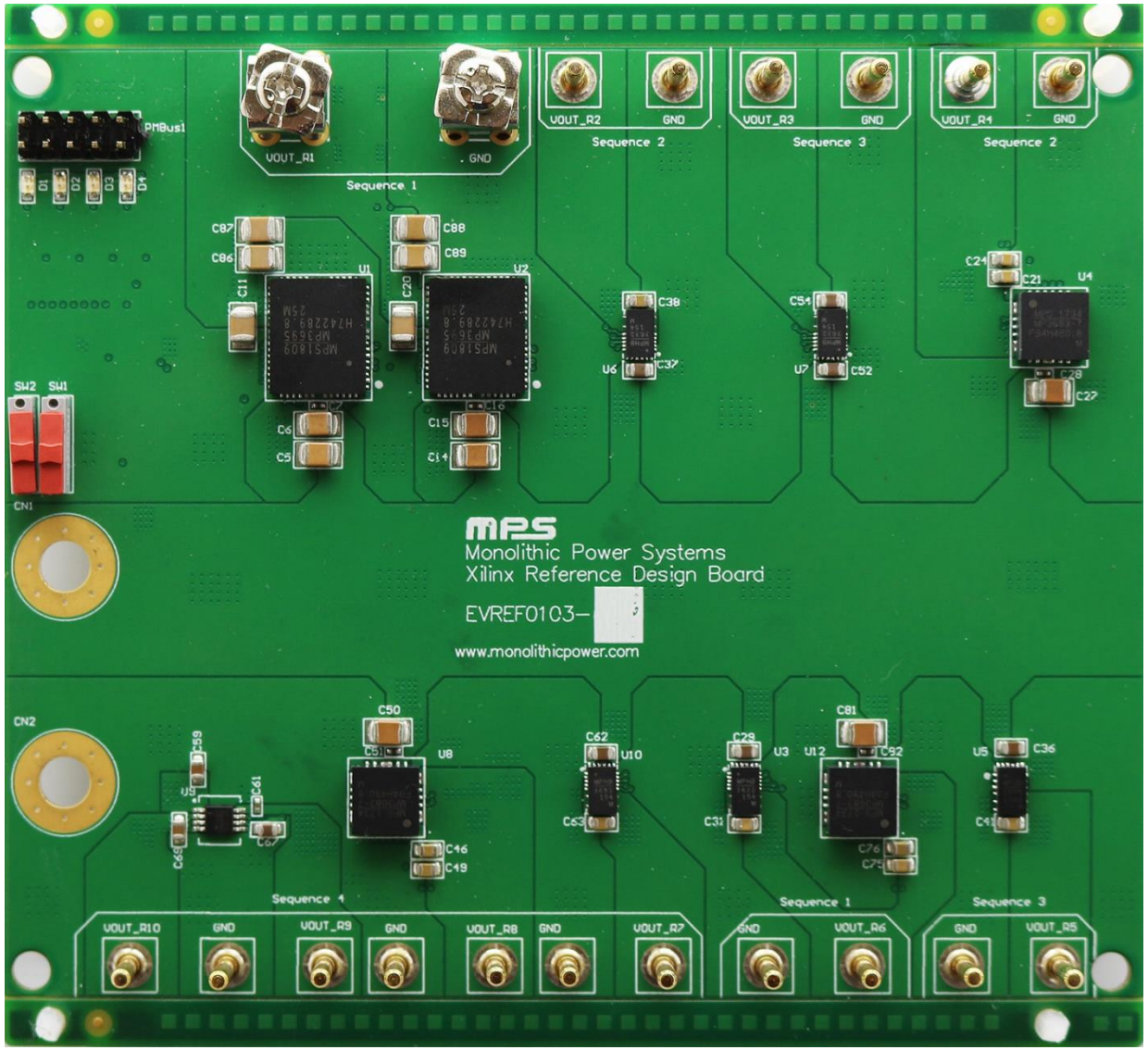


Summary of Low Power Version

Rail Number	Rail Name	VOUT	Limit	Max DC Load	Seq Up	MPS Part#	PCB Area
1	VCCINT	0.85V	±3%	20A	1	MPM3695-25	200 mm^2
2	VCCBRAM/ VCCINT_IO	0.9V	±3%	3A	2	MPM3632C	24 mm^2
3	VCCAUX/ADC	1.8V	±3%	3A	3	MPM3632C	24 mm^2
4	VMGTAVTT	1.2V	±3%	7A	2	MPM3683-7	75 mm^2
5	VMGTVCCAUX	1.8V	±3%	0.6A	3	MPM3606A	24 mm^2
6	VMGTAVCC	0.9V	±3%	3A	1	MPM3632C	24 mm^2
7	VCC_IO	3.3V	±3%	3A	4	MPM3632C	24 mm^2
8	VCC_DDR	1.2V	±3%	3A	4	MPM3683-7	75 mm^2
9	DDR_VTT	VCC_DDR/2	±3%	N/A	4	MP20075	19 mm^2
10	DDR_VREF	VCC_DDR/2					

Total Solution Size: 438mm^2

Reference Design Demo Board Picture

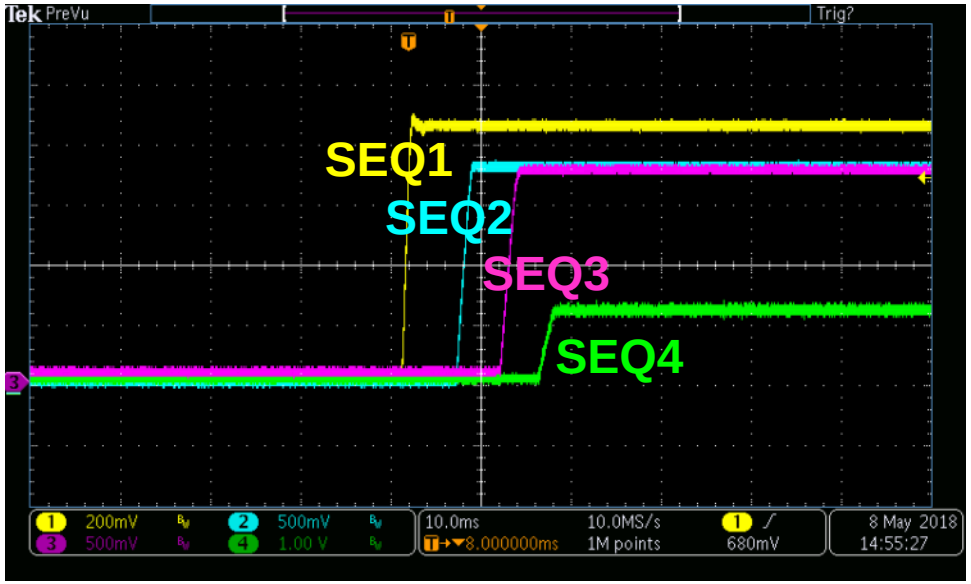


FPGA Series	FPGA P/N	Demo Board P/N	Core Current
Kintex Ultrascale+	KU13P, KU15P	EVREF0103-A	50A Peak
	KU3P, KU5P, KU9P, KU11P	EVREF0103-B	25A Peak

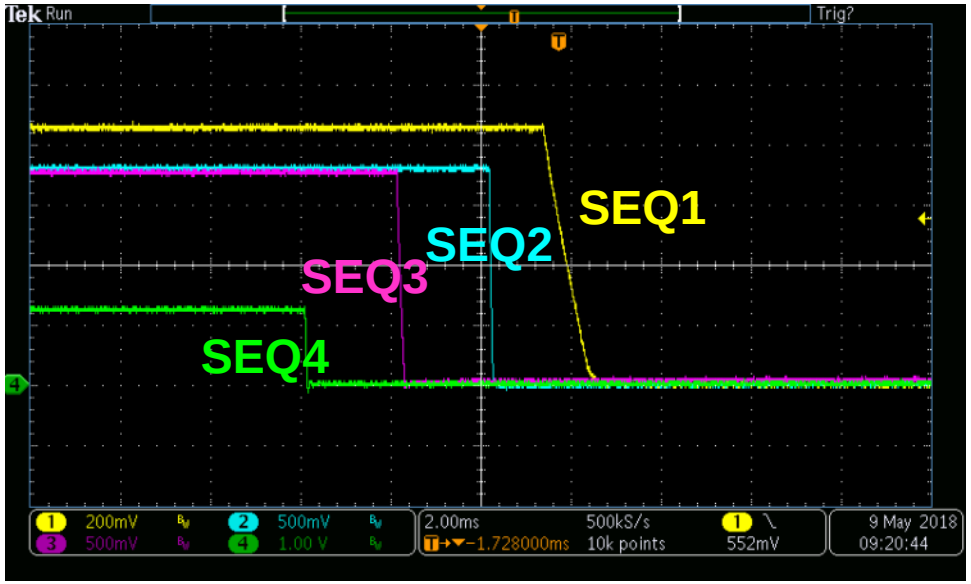
EVREF0103-A Test Report

Start up/Shut Down Sequence

Start-up Sequence



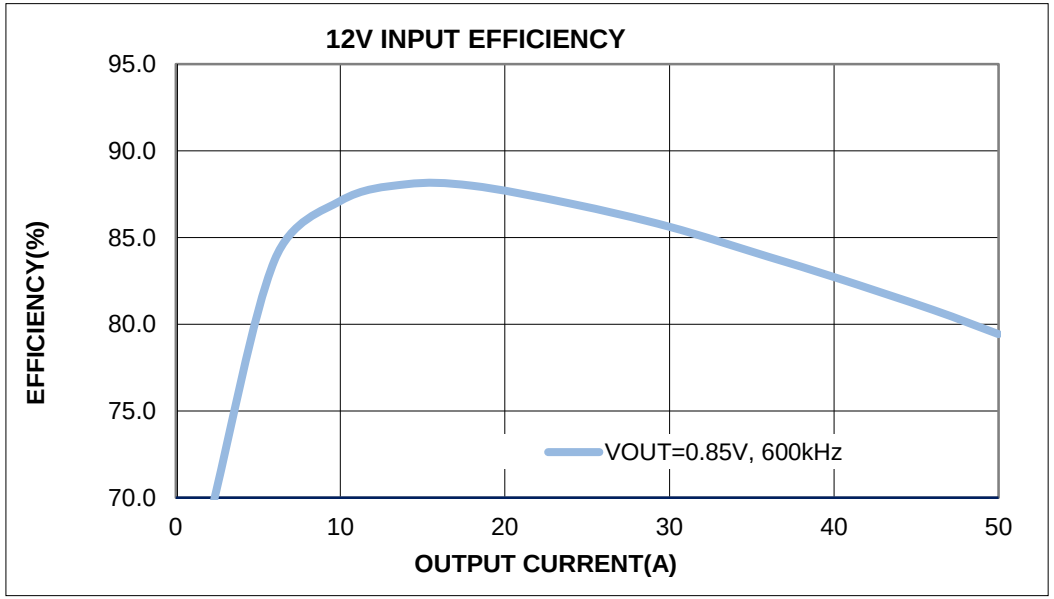
Shut-down Sequence



Rail 1 Efficiency and Transient Results

Testing condition: Dual-phase MPM3695-25, V_{IN}=12V, V_{OUT}=0.85V, f_{SW}=600kHz,
6 x 100uF ceramic output capacitors per phase + 220uF POSCAP

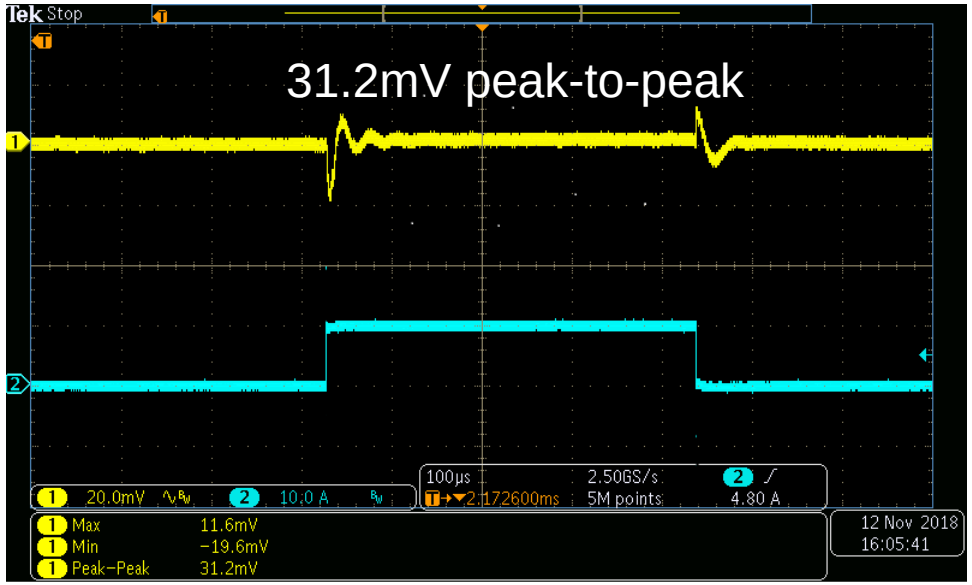
Efficiency vs. Load Current



CH1: V_{OUT}/AC Coupled, 20mV/Div

CH2: I_{OUT}, 10A/Div,

Load Transient Waveform
25% load step (10A at 100A/us)



100us/div

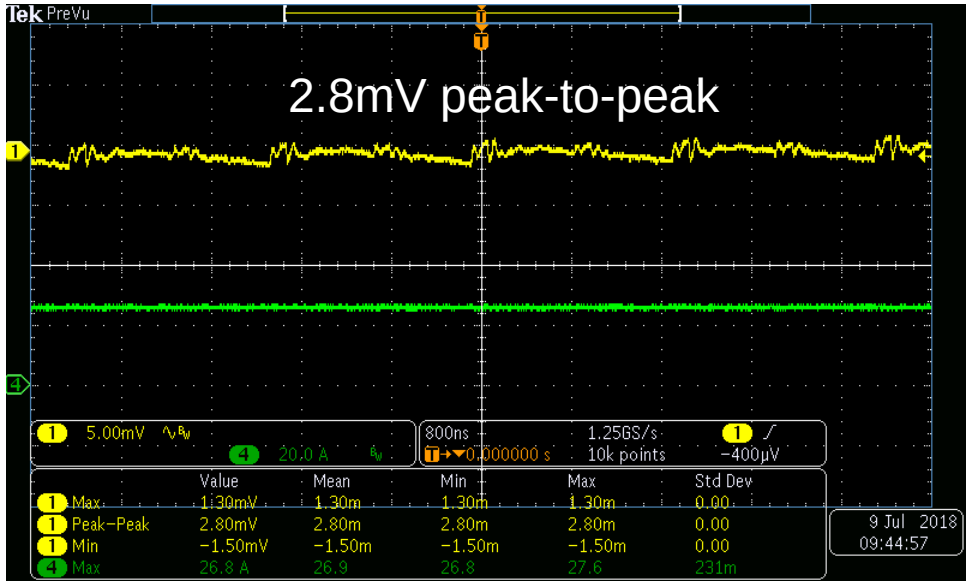
Rail 1 Output Voltage Ripple

Testing condition: Dual-phase MPM3695-25, V_{IN}=12V, V_{OUT}=0.85V, f_{SW}=600kHz,
6 x 100uF ceramic output capacitors per phase + 220uF POSCAP

Output Voltage Ripple at 25A Load

CH1: V_{OUT}/AC Coupled, 5mV/Div

CH4: I_{OUT}, 25A/Div

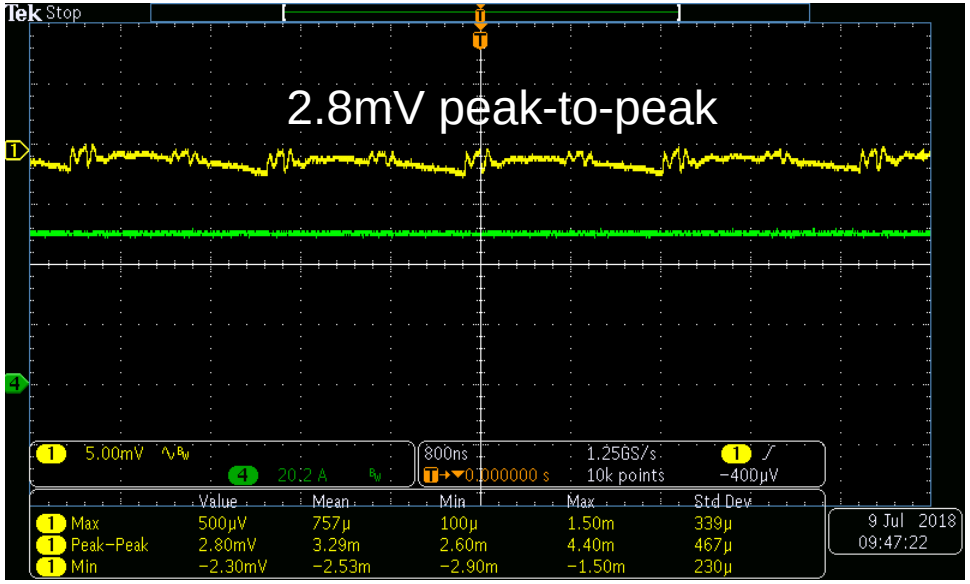


800ns/div

Output Voltage Ripple at 50A Load

CH1: V_{OUT}/AC Coupled, 5mV/Div

CH4: I_{OUT}, 25A/Div

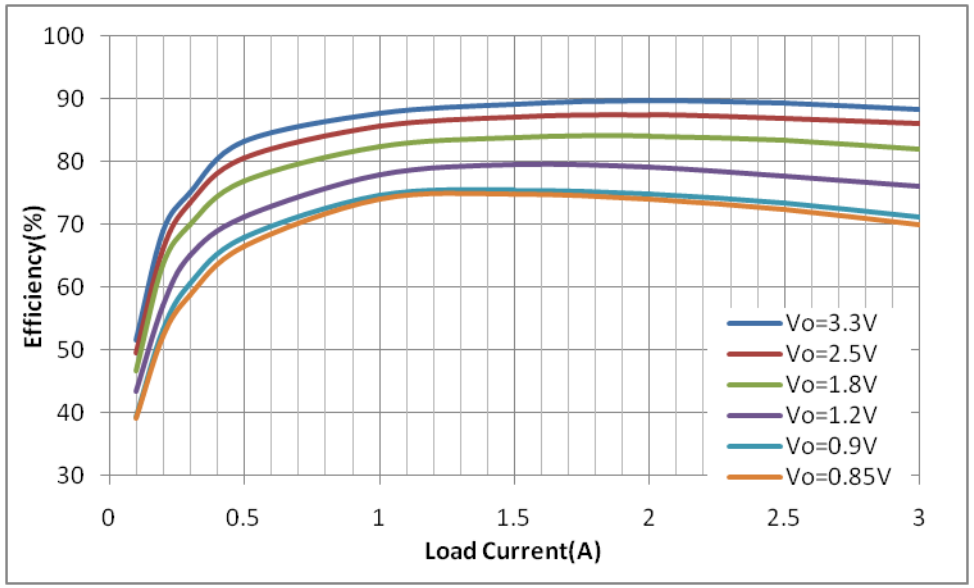


800ns/div

Rail 2 Efficiency and Transient Results

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=0.9V, f_{SW}=3000kHz, 47uF ceramic output capacitor

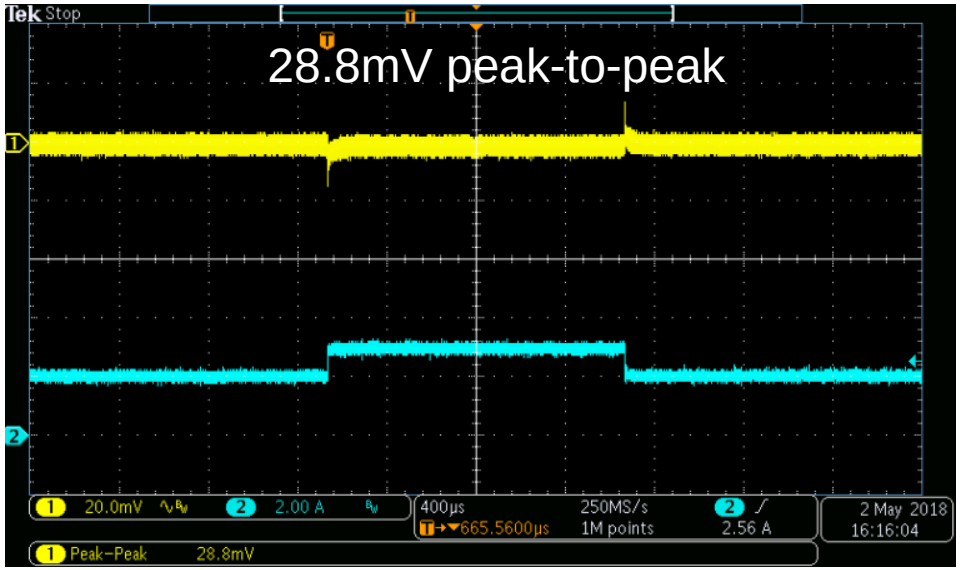
Efficiency vs. Load Current



Load Transient Waveform
40% load step (1.2A at 10A/us)

CH1: V_{OUT}/AC Coupled, 20mV/Div

CH2: I_{OUT}, 2A/Div



400us/div

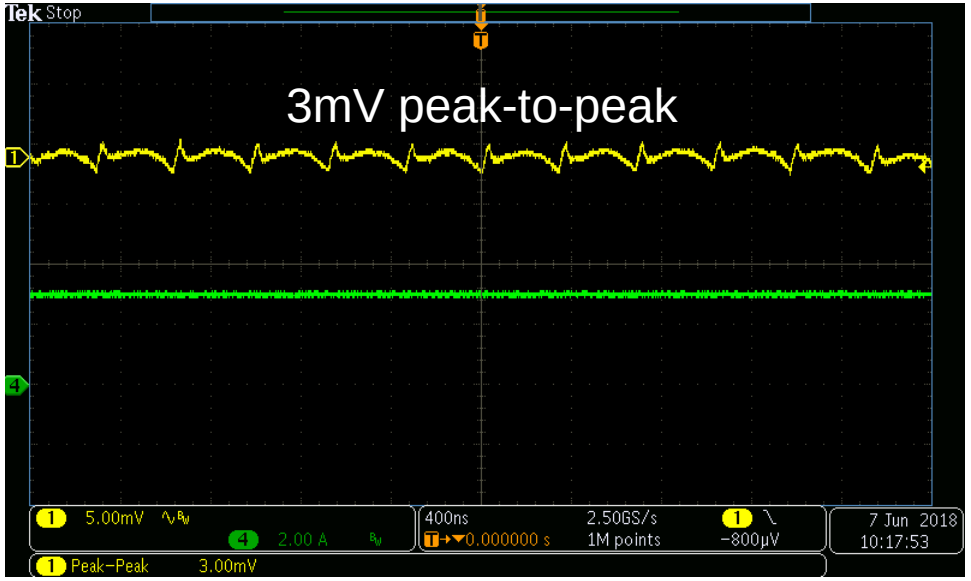
Rail 2 Output Voltage Ripple

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=0.9V, f_{SW}=3000kHz, 47uF ceramic output capacitors

Output Voltage Ripple at 3A Load

CH1: V_{OUT}/AC Coupled, 5mV/Div

CH2: I_{OUT}, 2A/Div

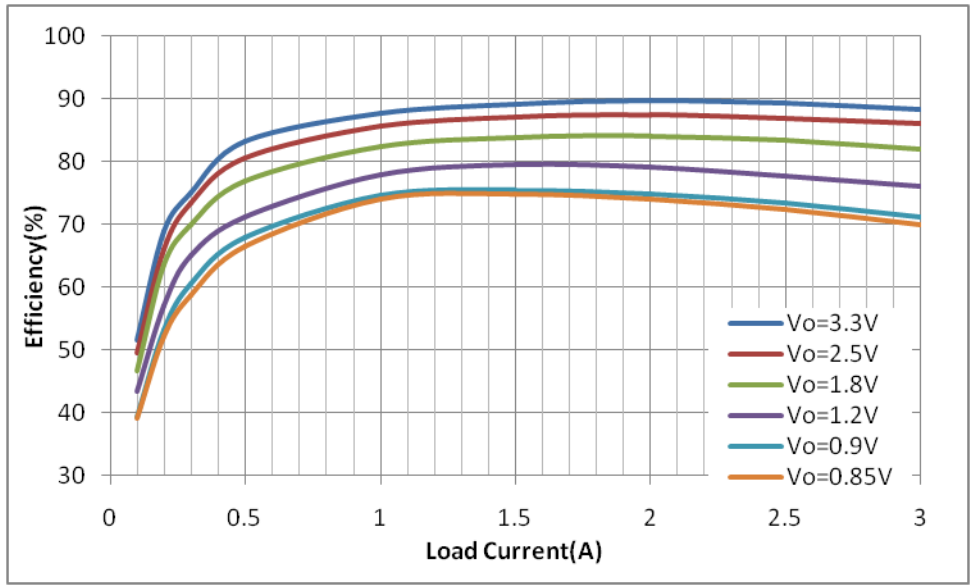


400ns/div

Rail 3 Efficiency and Transient Results

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=1.8V, f_{SW}=3000kHz, 47uF ceramic output capacitor

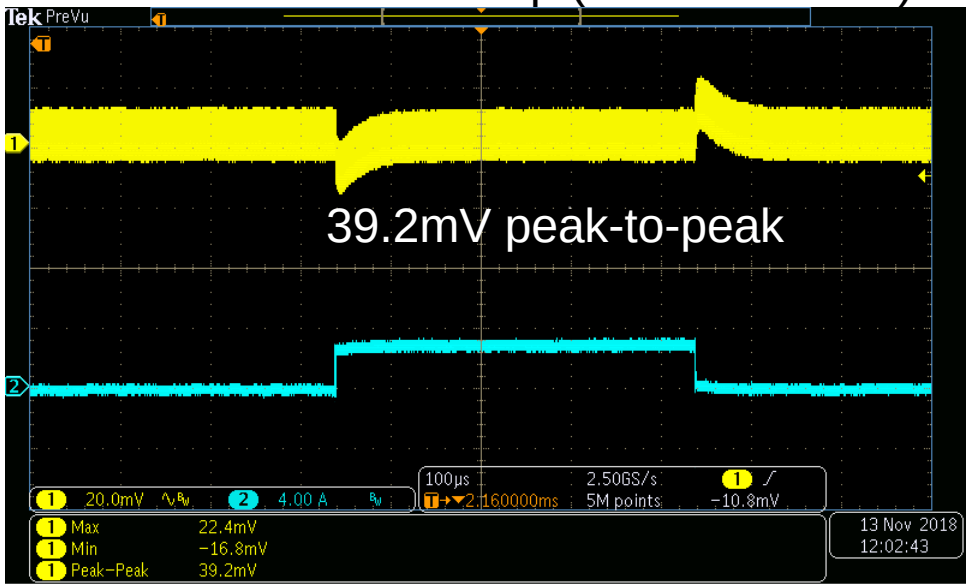
Efficiency vs. Load Current



Load Transient Waveform
90% load step (2.7A at 10A/us)

CH1: V_{OUT}/AC Coupled, 20mV/Div

CH2: I_{OUT}, 4A/Div



100us/div

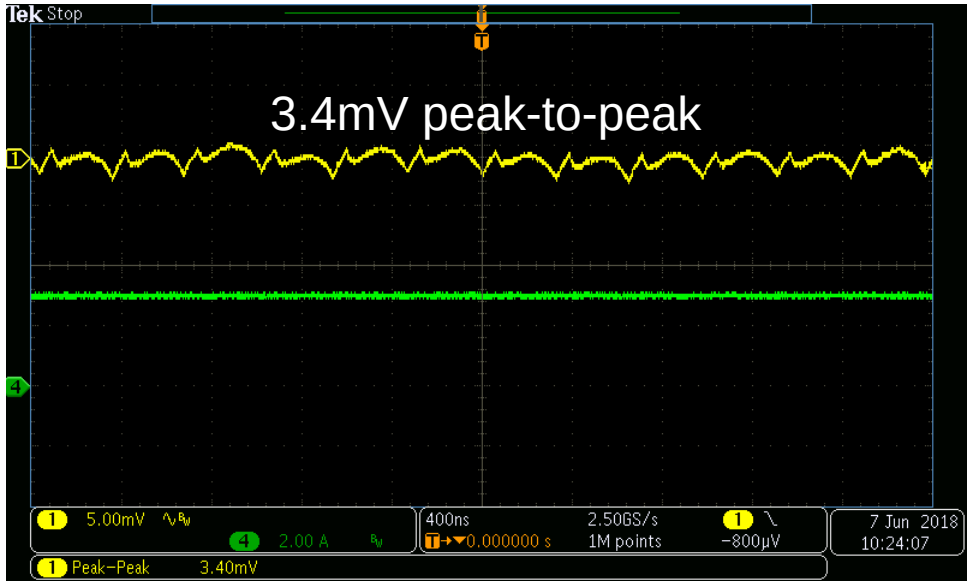
Rail 3 Output Voltage Ripple

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=1.8V, f_{SW}=3000kHz, 47uF ceramic output capacitor

Output Voltage Ripple at 3A Load

CH1: V_{OUT}/AC Coupled, 5mV/Div

CH4: I_{OUT}, 2A/Div

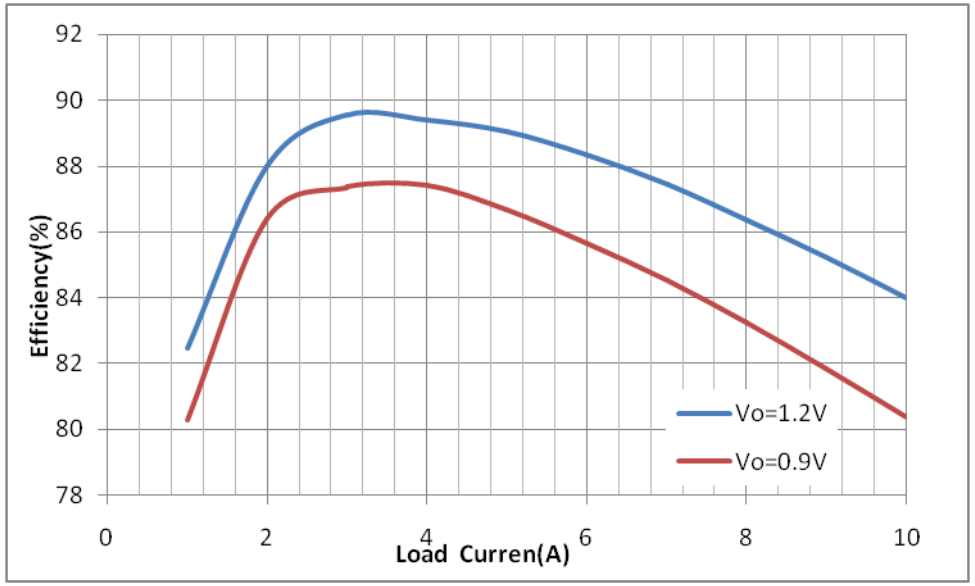


400ns/div

Rail 4 Efficiency and Transient Results

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=1.2V, f_{SW}=1000kHz, 6x47uF ceramic output capacitors

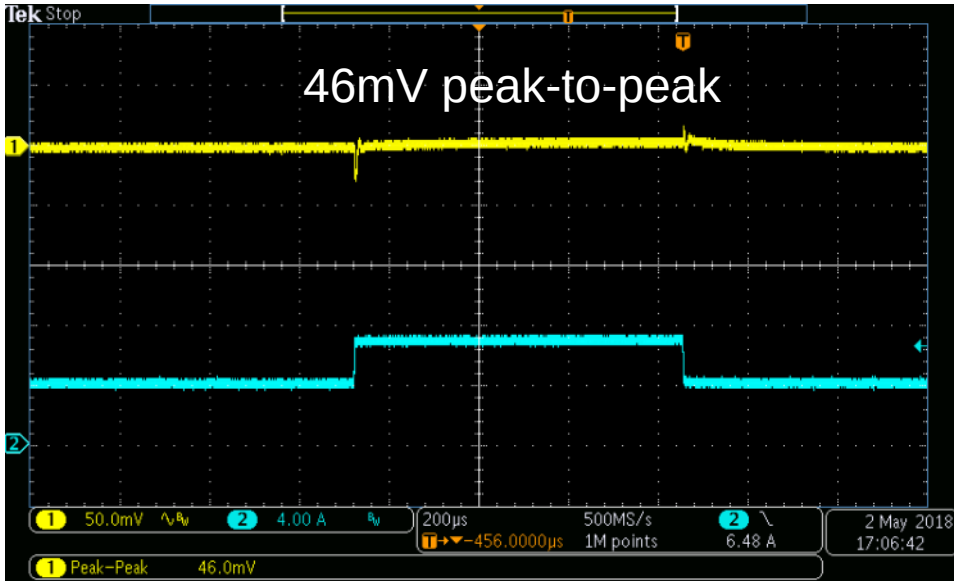
Efficiency vs. Load Current



Load Transient Waveform
25% load step (1.75A at 10A/us)

CH1: V_{OUT}/AC Coupled, 50mV/Div

CH2: I_{OUT}, 4A/Div



200us/div

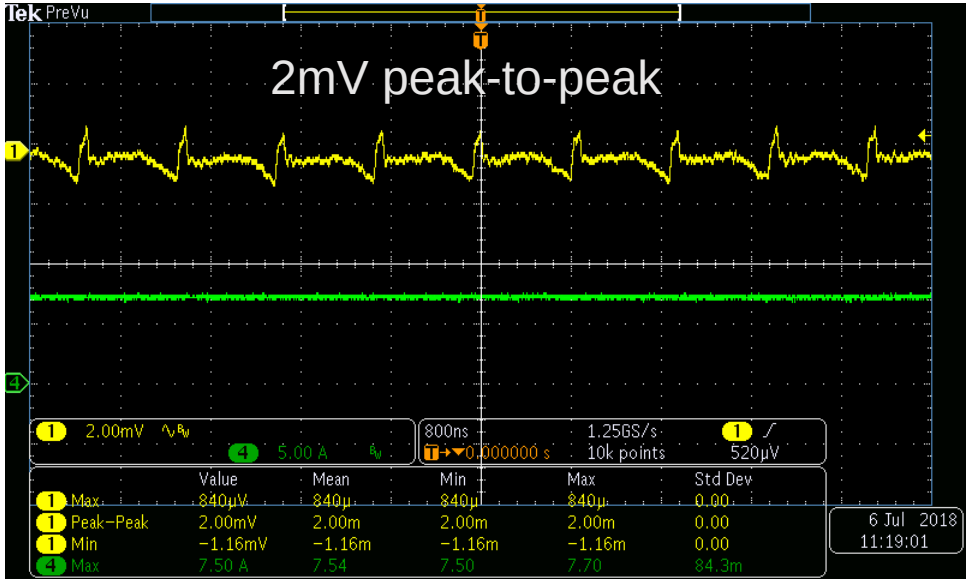
Rail 4 Output Voltage Ripple

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=1.2V, f_{SW}=1000kHz, 6x47uF ceramic output capacitors

Output Voltage Ripple at 7A Load

CH1: V_{OUT}/AC Coupled, 2mV/Div

CH4: I_{OUT}, 2A/Div

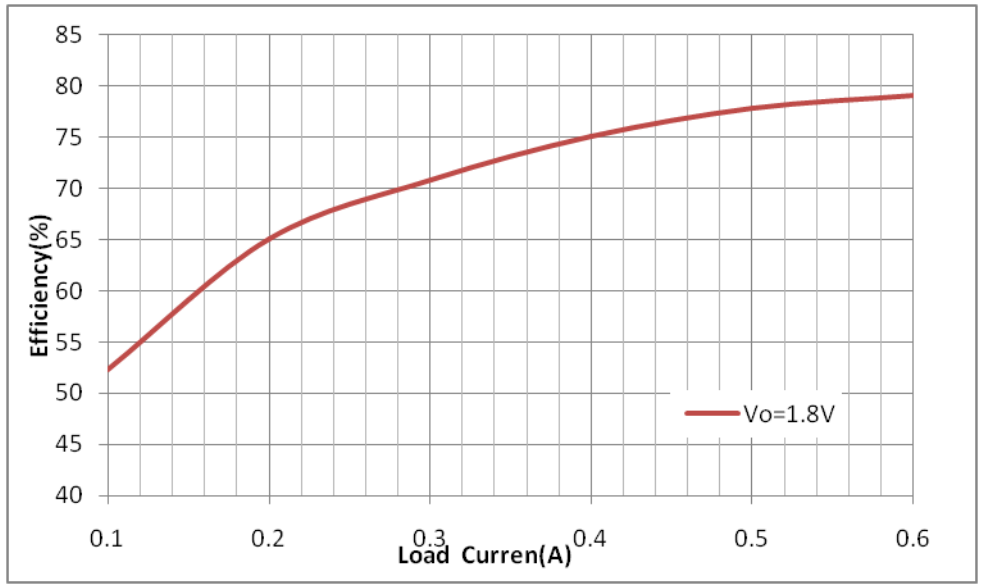


800ns/div

Rail 5 Efficiency and Transient Results

Testing condition: MPM3606, V_{IN}=12V, V_{OUT}=1.8V, f_{SW}=2000kHz, 47uF ceramic output capacitor

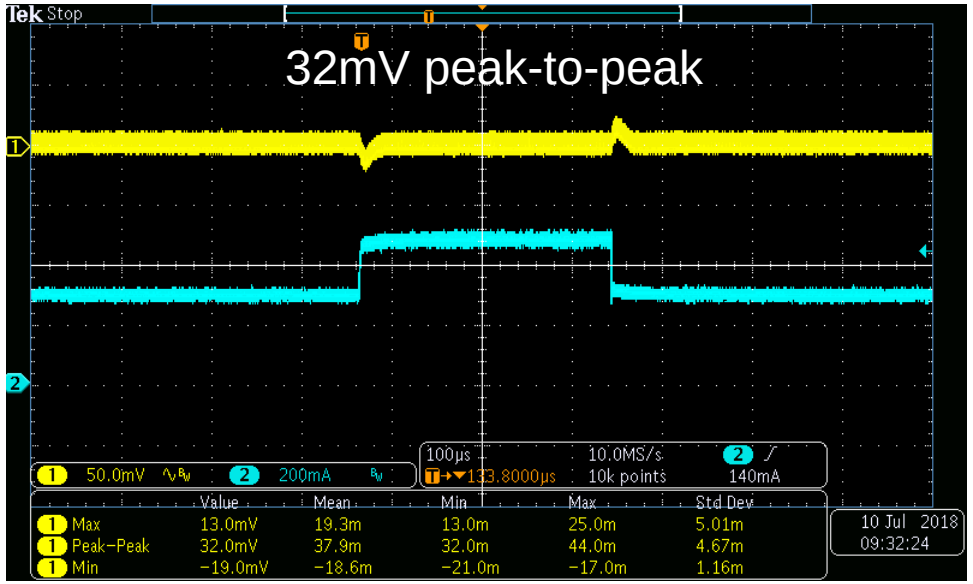
Efficiency vs. Load Current



Load Transient Waveform
$I_{OUT,}$ 25% load step (0.15A at 10A/us)

CH1: V_{OUT}/AC Coupled, 50mV/Div

CH4: $I_{OUT,}$ 0.2A/Div



80us/div

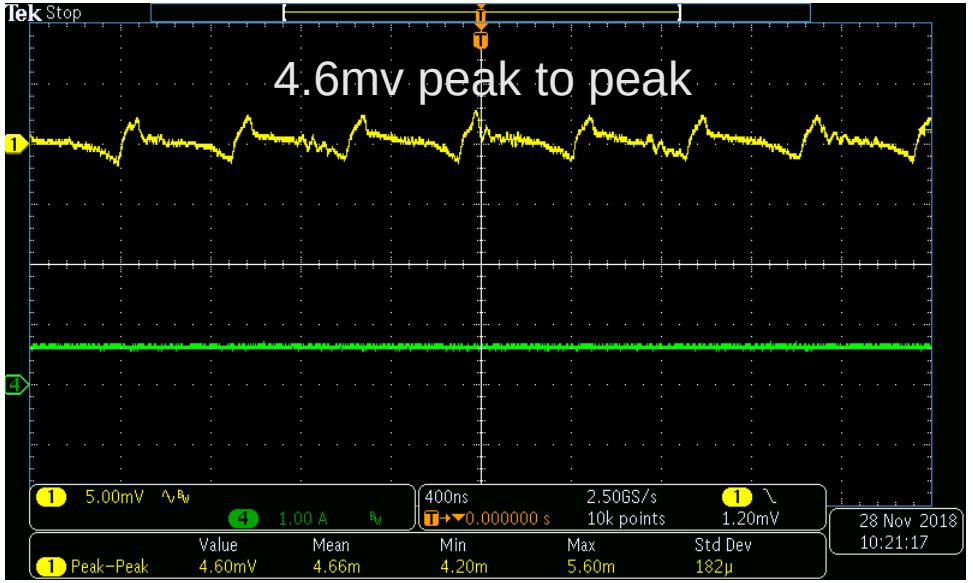
Rail 5 Output Voltage Ripple

Testing condition: MPM3606, V_{IN}=12V, V_{OUT}=1.8V, f_{SW}=2000kHz, 47uF ceramic output capacitor

CH1: V_{OUT}/AC Coupled, 5mV/Div

CH4: I_{OUT}, 1A/Div

Output Voltage Ripple at 0.6A Load

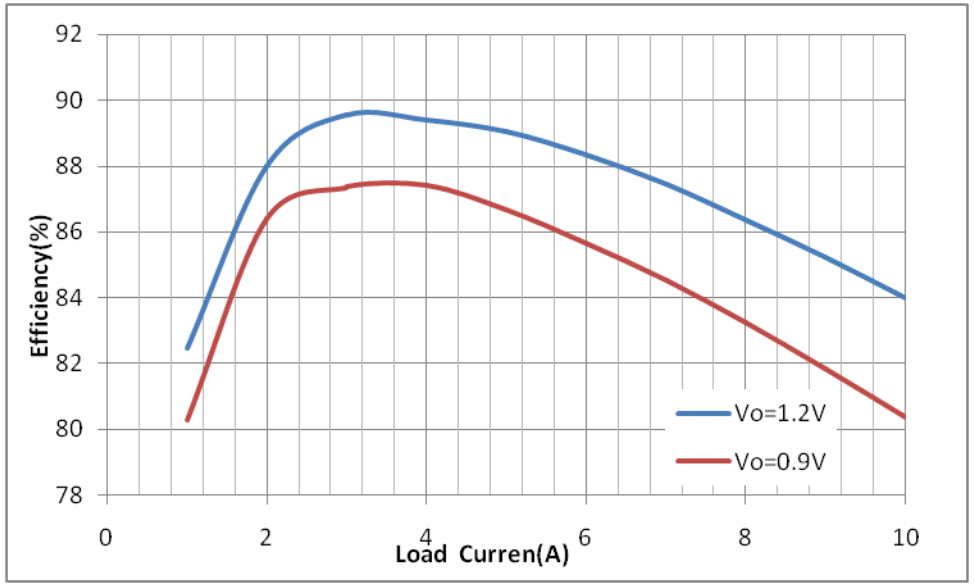


400ns/div

Rail 6 Efficiency and Transient Results

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=0.9V, f_{SW}=1000kHz,
6 x 47uF ceramic output capacitors

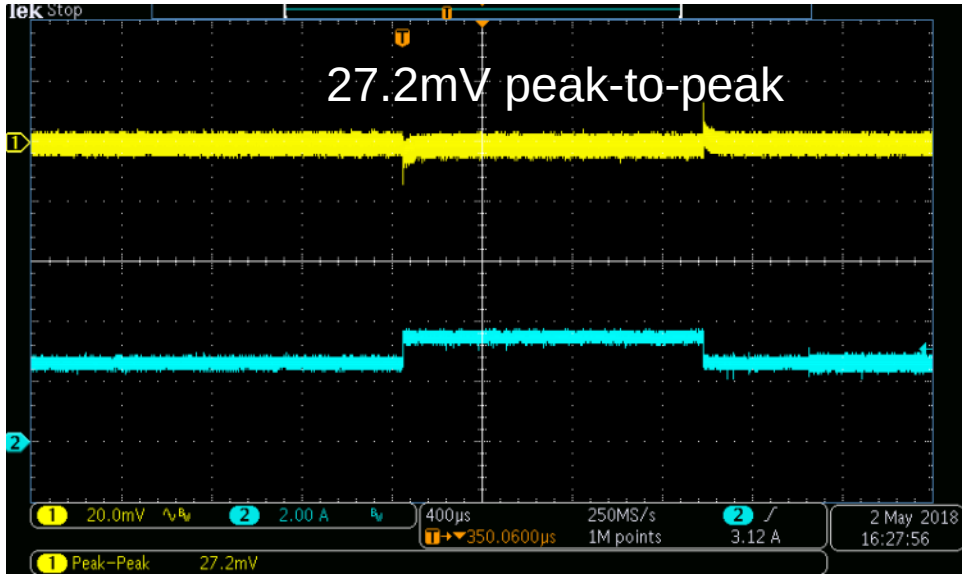
Efficiency vs. Load Current



CH1: V_{OUT}/AC Coupled, 20mV/Div

CH2: I_{OUT}, 2A/Div

Load Transient Waveform
25% load step (0.75A at 10A/us)



400us/div

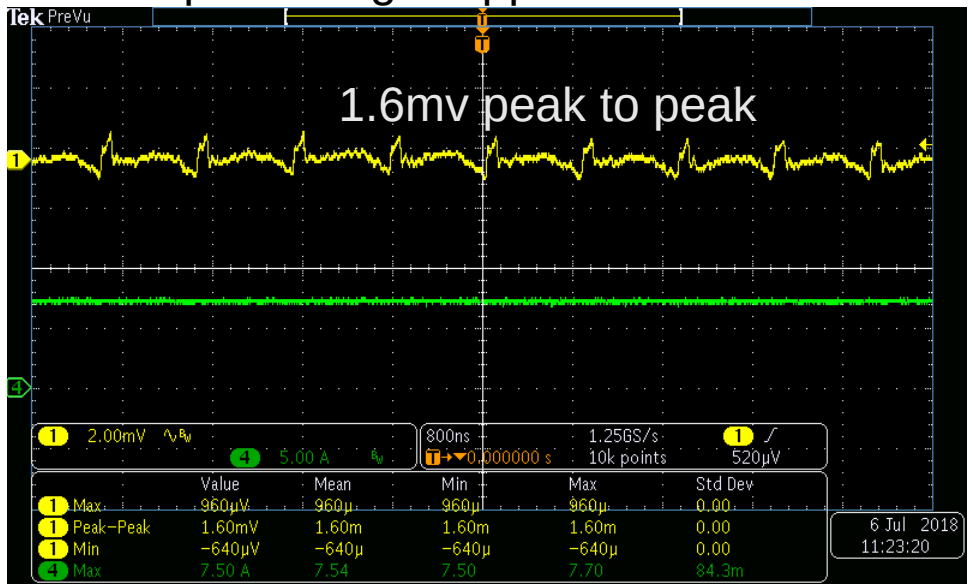
Rail 6 Output Voltage Ripple

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=0.9V, f_{SW}=1000kHz,
6 x 47uF ceramic output capacitors

Output Voltage Ripple at 7A Load

CH1: V_{OUT}/AC Coupled, 2mV/Div

CH4: I_{OUT}, 5A/Div

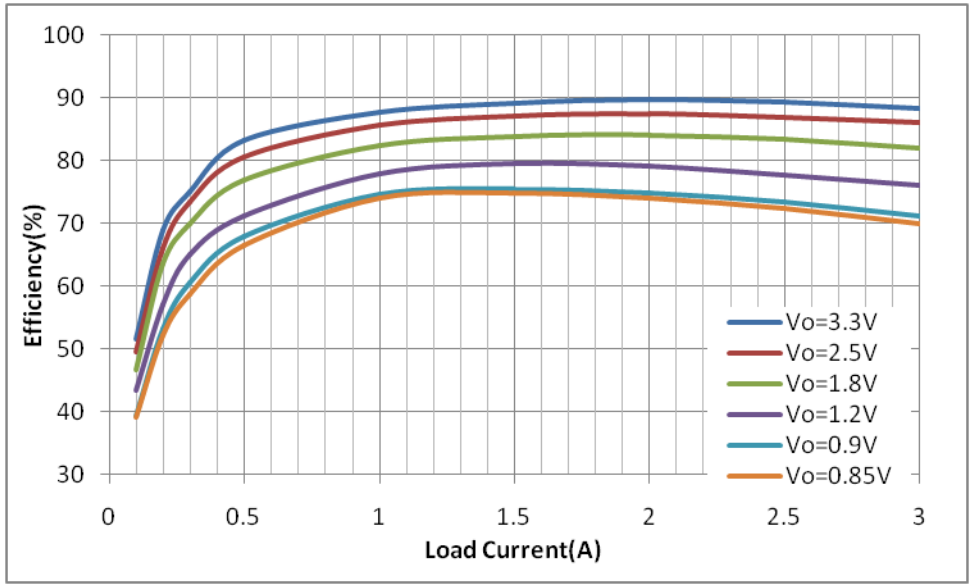


800ns/div

Rail 7 Efficiency and Transient Results

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=3.3V, f_{SW}=3000kHz, 47uF ceramic output capacitor

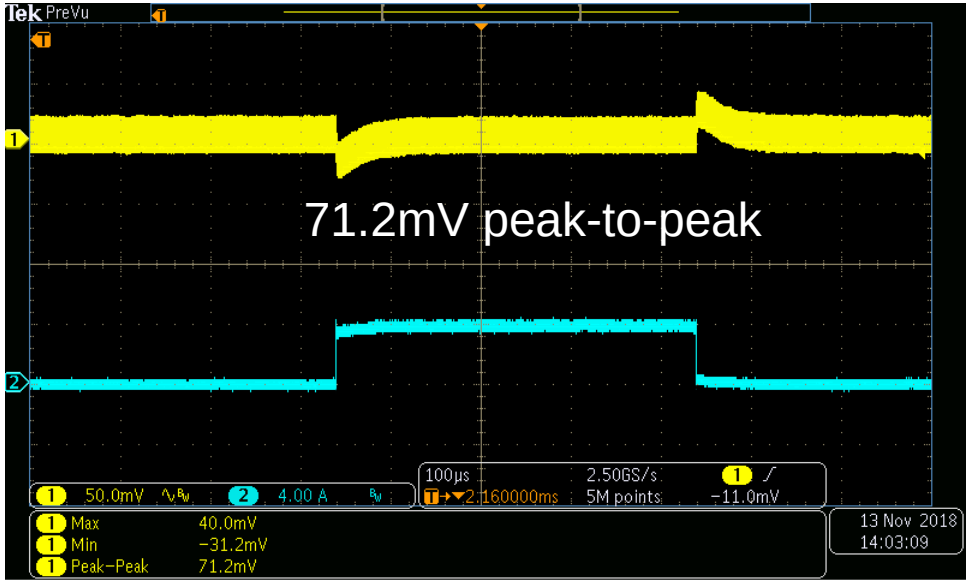
Efficiency vs. Load Current



Load Transient Waveform
90% load step (2.7A at 10A/us)

CH1: V_{OUT}/AC Coupled, 50mV/Div

CH4: I_{OUT}, 4A/Div



100us/div

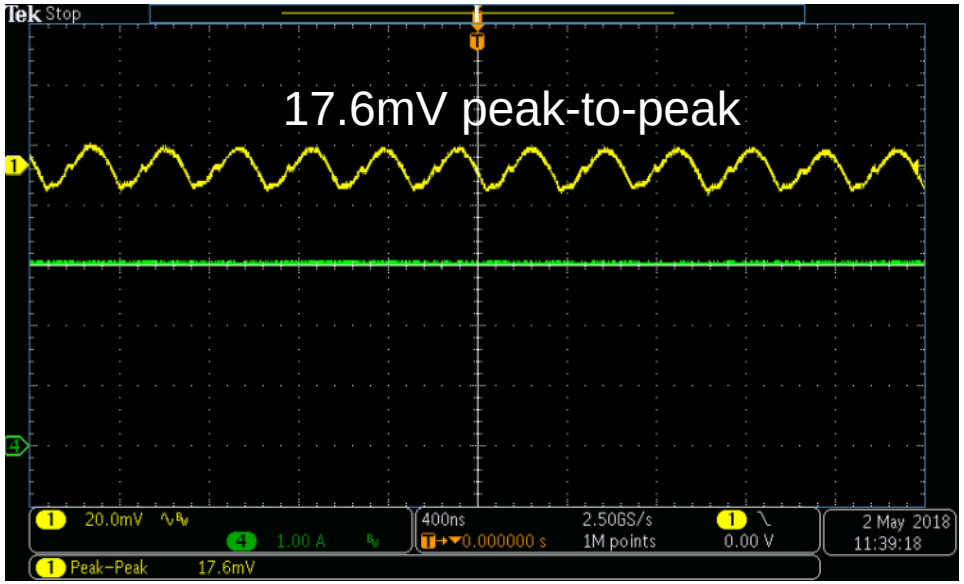
Rail 7 Output Voltage Ripple

Testing condition: MPM3632C, V_{IN}=12V, V_{OUT}=3.3V, f_{SW}=3000kHz, 47uF ceramic output capacitor

Output Voltage Ripple at 3A Load

CH1: V_{OUT}/AC Coupled, 20mV/Div

CH4: I_{OUT}, 1A/Div

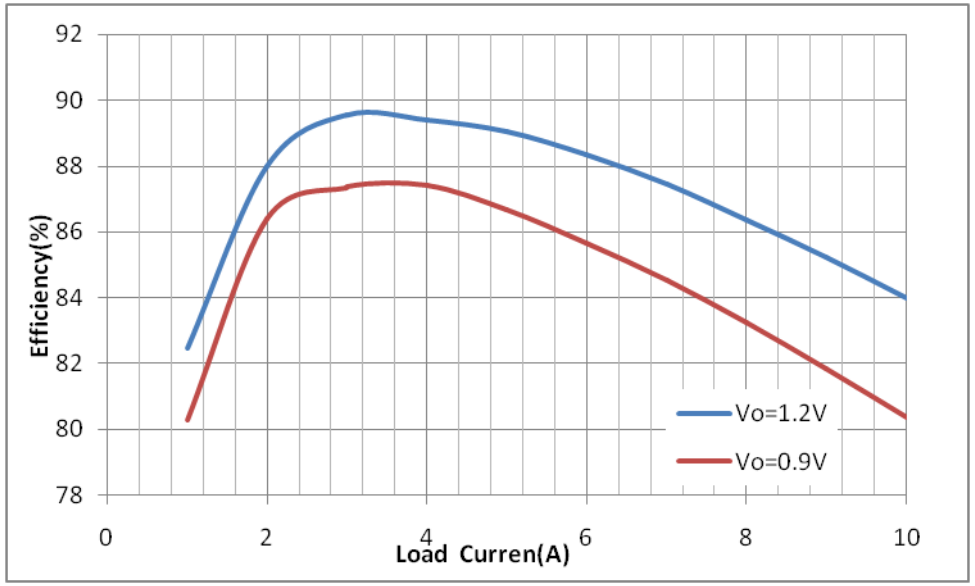


400ns/div

Rail 8 Efficiency and Transient Results

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=1.2V, f_{SW}=1000kHz, 6x47uF ceramic output capacitors

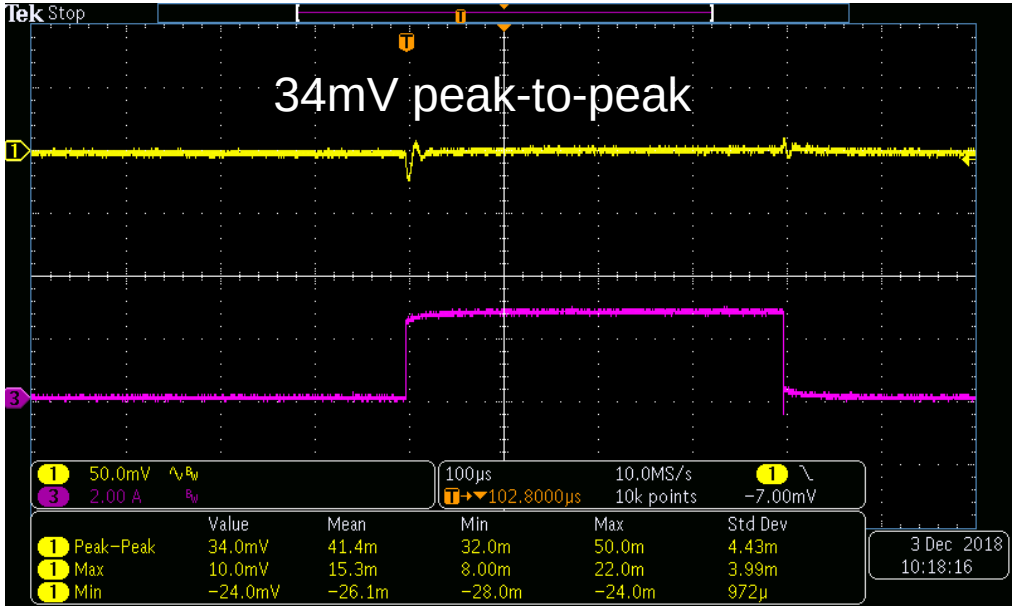
Efficiency vs. Load Current



CH1: V_{OUT}/AC Coupled, 50mV/Div

CH2: I_{OUT}, 2A/Div

Load Transient Waveform
80% load step (2.4A at 10A/us)



200us/div

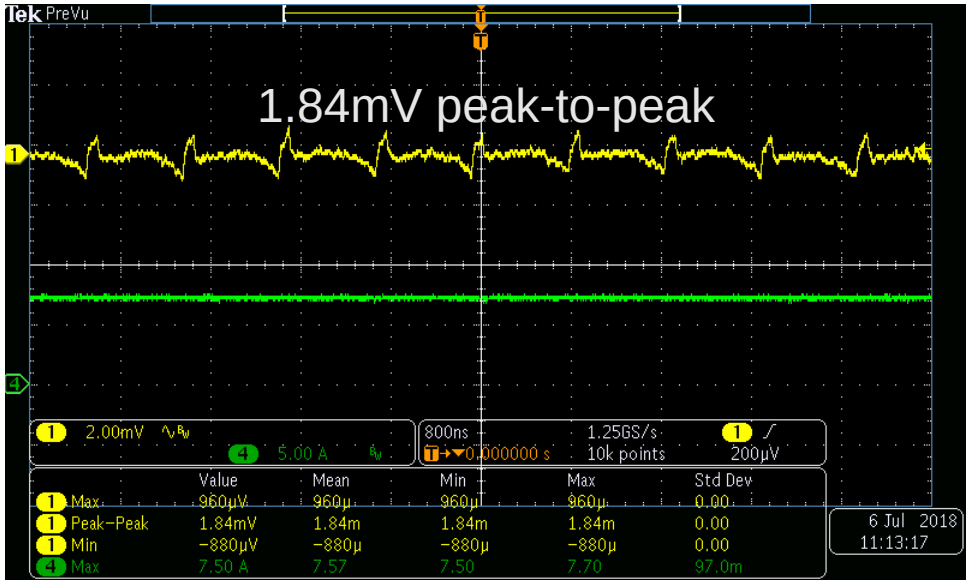
Rail 8 Output Voltage Ripple

Testing condition: MPM3683-7, V_{IN}=12V, V_{OUT}=1.2V, f_{SW}=1000kHz, 6x47uF ceramic output capacitors

Output Voltage Ripple at 7A Load

CH1: V_{OUT}/AC Coupled, 2mV/Div

CH4: I_{OUT}, 2A/Div



800ns/div